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ABSTRACT

A philosophical overview of the place of technology in higher education and especially in teaching is presented. Research can be viewed as the acquisition of knowledge; teaching as its transmission; and service as its application. Technology affects the transmission of knowledge in both the teaching process and the content of teaching. The computer permits scientists to share work with one another through networking and enables research teams to span institutions. However, networking among a highly select group of collaborators narrows the community with access to the latest research. The impact of computer technology on instruction and testing in the humanities will remain limited. Except for introductory language instruction, the humanities disciplines do not easily lend themselves to sequential instruction or to true-false and multiple-choice examinations. However, word processing software will renew the importance of writing and editing in the humanities by eliminating the laborious side of rewriting and allowing the teacher to provide substantial editing aid. Additional topics that are addressed include: Francis Bacon's views on power acquired through knowledge, medical ethics and technology, and the influence of the printing press and television on the teaching process and the humanities. (SW)

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TECHNOLOGY, TEACHING, AND THE FUTURE

William F. May

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This essay on technology, teaching, and the future will cover both less and more than the announced title: less, because it will not discuss one-third of the advertised subject, that is, the future.

That omission will disappoint some. Our thirst for knowledge about the future knows few limits. Conferences abound on the subjects of "Business and the 80's," "Medical Ethics Ten Years Ahead," "The U.S.A. in the 21st Century." Our anxiety about the future is understandable enough. It goes back to the Greek general and his need to consult the entrails of birds on the eve of battle. Leadership means going--going ahead into the uncertain X of tomorrow. And that X stirs anxiety in decision-makers. Hence, the need for propnets and oracles, the modern equivalent for which is the consultant. In our day, consulting is a growth industry. Within the academy, social scientists have largely trained those experts who traffic in predictions. As opposed to humanists who deal with cultures in their singularity and who orient to great texts of the past, social scientists deal cross-culturally with human behavior in its generality and orient to the future.

But social scientists have recently turned more cautious about their capacity to discern the future. They used to talk about prediction, but they have down-shifted from predictions to projections, and more recently from projections to scenarios, and to multiple scenarios at that.

I tend to be cautiously agnostic about the future. As hard as we try to peer into the future (or buy books that cry shrilly of future shock) the future truly shocks because it is not transparent. For at least two reasons, the future confronts us as opaque.

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First, the radical novelty of discovery and invention. While we can follow the track of discoveries and inventions already here or guess at the vector of others subject to incremental changes, or anticipate the widespread applications of still others, we cannot anticipate radical novelty, radical invention, because if we did, in a sense it would already be discovered, invented, already here.

Second, we can, in a sense, anticipate the impacts of technology on human beings, but, unless we are already convinced technological determinists and assume that human beings are wholly the victims of what they have wrought, we cannot predict what human beings will do with a given invention and application as it spreads throughout a culture. Thus freedom, as well as radical discovery, renders the future opaque.

That leaves me, then, with two-thirds of the title: technology and teaching. But I hope to broaden that title. I warned those who invited me to New Mexico State University that I was not competent to appear as an expert either on the computer or data base retrieval systems. They assured me that the university has its own in-house experts on that. Rather they wanted me to step back a bit and provide a philosophical overview on the general place of technology in the setting of an institution of higher learning, especially in its teaching enterprise. I accepted this assignment in the hopes of providing a general framework for which the real experts in subsequent sessions can provide more detail.

The business of a university is knowledge; technology links with knowledge at three points: its acquisition; its transmission; and its application. These three modalities of knowledge remind us of the threefold criteria by which universities judge their faculty members for tenure and promotion: research refers to the acquisition of knowledge;

teaching, to its transmission; and service, to its application. In assessing, however, live faculty members--those strange folk who talk and write for a living, fall in love, and worry about salary increases and retirement benefits--the emphasis falls on the first two criteria, research and teaching. In the assessment of technology, almost all the emphasis falls on service.

1. Technology and the application of knowledge. The emphasis on the value of knowledge as "service" shows up in almost all work on the subject of technology. Consider, for example, Daniel Bell's essay on "Technology, Nature and Society." He defines technology as "The effort to transform nature for utilitarian purposes."[1] He roots this power and effort in homo faber, man the maker, and cites the classical myth of Prometheus, who stole the fire of reason and creativity from the gods. But the Greeks chiefly celebrated the human capacity for reason not the capacities acquired through reason that might serve human purposes. The West had to wait for Giordano Bruno and Francis Bacon of the late sixteenth and early seventeenth centuries for its hymns of praise to a knowledge linked with dominion and power. Bruno wrote:

> The gods have given man intelligence and hands, and have made him in their image, endowing him with a capacity superior to other animals. This capacity consists not only in the power to work in accordance with nature and the usual course of things...but beyond that...to the end that by fashioning, or have the power to fashion, other natures, other courses, other orders by means of his intelligence, with that freedom without which his resemblance to the deity would not exist, he might in the end make himself god of the earth.[2]

Bacon, from this point forward (1583-5), felt that "a new order of events was at hand, the specific quality of which would consist no longer in a mere imitation of nature but in her domination by man."[3] Inasmuch as knowledge is power, the virtue of curiosity leads to virtuosity--the capacity to work great changes in nature--to produce magnalia naturae to match magnalia dei.

This godlike power, moreover, that flows from knowledge should redound to the benefit of humankind. Francis Bacon linked knowledge and power with universal benefit. This philanthropic outcome distinguishes scientists from mere magicians and alchemists. Wizards and magicians link knowledge with power, but they are tempted to think in proprietary terms about that powerful knowledge which they display. Bacon complained that they transform nature, but simply in order to arouse wonder and not to serve some larger human purpose. They are vain-glorious and self-seeking. They believe themselves to belong to a privileged class of illuminati, hermetically sealed off from the human race at large. The scientist, Bacon insisted, must add the virtue of philanthropy to those of curiosity and virtuosity. As Benjamin Farrington has observed, the new knowledge to be gained should be "...fed back into the industrial life of the nation. This was no small task, as Bacon well knew. It was King's business. It should not be left to the monk in the cloister, the alchemist's furnace, the rich nobleman's curiosity or the workshop of the artisan. It required to be taken under the wing of the government. For it was not simply an addition to knowledge but the inauguration of a new way of life, the great instauration of man's dominion over the universe."[4]

Bacon, take note, spoke of man's dominion over the universe, not of the dominion of some men over the universe, or of some men over other men, or of one generation over future generations. This universalist impulse distinguishes the scientist from the parochial magician, the wayside wizard, and the hermetical alchemist. The enlargement of powers reflected not the limited triumph of some, but the enhancement of the many. To this very day, we hold on to this sense of participation in knowledge and power. "One small step for man, a giant step for mankind." When we hear talk about the enlargement of human powers through science we are inclined to neglect the questions of whose power over what, at what price, and over whom, the question that especially haunts some today in the grand schemes for genetic engineering. We are inclined to gloss over these pointed questions and assume that the power acquired through knowledge eventually runs off into a kind of reservoir of power at the general disposition of the human race.

2. Technology and the acquisition of knowledge. Technology serves also the research enterprise. Here the emphasis falls not on utility and service but on knowledge as an end in itself. The myth of the holy grail, the quest for the intrinsic good replaces Bacon's Boy Scout myth of the great philanthropist.

I do not need to rehearse in this setting the role that technology has played in the acquisition of knowledge. The chairperson for every department in the sciences knows just how important technical equipment is to the research enterprise. It casts the most towering shadow across the budget. It affects the ability of the department to recruit its faculty members. Yet it is the sine qua non of a cathedral, research institution and almost every ambitious university campus has aspired to become such.

Nowhere has the importance of technology loomed larger in research than in the life sciences and there it has created problems for the notion of knowledge as an unconditional and intrinsic good. First, and most dramatically, the recombinant DNA debate posed questions about knowledge as an absolute good. Although that debate has largely resolved in favor of the advocates of such research--the dangers proved to be much less than first feared--the debate lifted a rock that exposed much to light.

When advocates for the research sold the enterprise to the community at large, they relied on the Baconian links between knowledge, power, and boon. They held out the prospects that the research would lead to a knowledge and perhaps control and cure of a variety of cancers and inherited diseases, such as diabetes and hemophilia, to the production of inexpensive new vaccines and plants that draw their nitrogen directly from the air rather than from costly fertilizers, and to a vastly improved knowledge of the genetics of all plants and animals and, eventually, humankind.

Other advocates of the research, however, appealed not to wondrous applications but rather to an unconditional right to know. The latter appeal raised the most interesting questions. It invoked the deepest of commitments to academic freedom. Critics of this second appeal noted that advocates of the research were, in fact, extending the doctrine of the right to know beyond its traditional limits. They were claiming not simply the right to know but the right to create unprecedented forms of life in order to attain that knowledge. Technology, in this case, is not simply an incidental by-product of the research but its indispensable pre-condition.

The special links between technology and the acquisition of knowledge in recombinant DNA research led to worries in the scientific community and in the public at large and to the development of federal guidelines. Some scientists, in turn, worried that such guidelines would constitute the wedge that would undercut the nitherto unconditional quest for knowledge. Today the geneticists, tomorrow, the linguists! The argument, however, based on the thin edge of the wedge, cuts only so deep. Federal regulations in this case would not justify a limitless intrusion on the right to know but regulate that right only as it requires the production of new forms, the deleterious consequences of which may possibly be great but cannot be fully assessed in advance.

As it turns out, those consequences have not been as serious as first feared. But some measure of caution made sense, at the outset, and scientists showed restraint at the Asilomar Conference. The fact of uncertainty attendant to the original research invited some wariness. It argued not for the green light of the technological triumphalists or the permanent red light of the alarmists but for an amber light. This caution itself may have some exemplary force as the society proceeds to the subsequent assessment of industrial applications. We cannot bemoan wanton and runaway applications if we have not laid carefully our moral foundations in the very acquisition of krowledge.

3. Technology and the transmission of knowledge. Broadly conceived, teaching includes not only the instruction of students but the teaching of colleagues. Writing for publication is part of the transmission of knowledge. Faculty members engage in teaching when they write articles, monographs, book reviews, and books. It is teaching without a classroom,

teaching to a wider audience of peers, who may or may not yet be engaged in a similar research enterprise. Thus, this essay on technology and teaching will have to consider the dual settings of students and colleagues.

The subject of technology, as it affects the transmission of knowledge, divides into two parts: the impacts of technology on the process of teaching and on the content of teaching. Impacts on the process of teaching further divide into impacts on the sciences and the humanities. I will emphasize the effects on the humanities because I am more competent to discuss the humanities and partly because impacts there may, in the long run, be more striking.

a. The Process of Teaching in the Sciences. The impact of recent technology on instruction and testing in the sciences is large, but, in two ways, conservative. First, it continues to strengthen the ancient apprenticeship system. Long before the advent of the computer, the enormous importance of equipment in scientific research and the need to cultivate in students research techniques had a conservative impact on instruction. The young learned by initiation into the research enterprise under the tutelage of senior scientists. They assimulated the activities of the research team. This apprenticeship system is a very old teaching tradition indeed, which the computer and other technological advances would not appear significantly to alter.

Second, instructors in the sciences will probably assimilate and utilize computer technology without disturbing the traditional characteristics of scientific instruction as sequential, incremental, and oriented to problem-solving. Further, the computer facilitates traditional modes of testing in the sciences. It handles superbly the

grading of multiple-choice and other types of examinations that allow for straightforward verification and falsification. In these aspects, the computer fits in with the sciences less disruptively than with traditional modes of instruction and testing in the humanities. With the exception of language study, knowledge and therefore course instruction in the humanities are only waywardly sequential. Further, the humanistic disciplines orient to problems which are hardy perennials rather than solubles, and they produce results more aptly displayed in interpretive essays, rather than in isolable true and false statements. On the face of it, the impact of the computer on scientific instruction and testing would disrupt traditional patterns less dramatically than in the humanities.

Although the computer would not seem to alter significantly patterns of student instruction in the sciences, it will change dramatically the mutual instruction that goes on amongst peers in scientific research. The computer permits scientists to contact one another and teach one another through "networking." This rapid computer access to the work of colleagues alters the meaning of publishing, the role of the library, and perhaps even the role of the local campus in peer instruction.

-Traditionally, scientists went public through publishing; thereby teaching others and exposing their work to peer criticism. But the speed with which exchanges can occur through computer networking may, at least in some settings and for some fields today, convert the formal act of publishing into a ritual of little more than archival/historical significance. The tedious lead-time required to place articles in

journals today forces publications to lag even further behind the numerous exchanges and transmissions that occur through networking. The book becomes, at best, the tortoise in the transmission of scientific knowledge.

-Librarians have recognized these changes in the making and have begun to think of themselves as information centers rather than vaults for books. In some fields the data bank is crucial.

-Computer networking may also reduce the significance of the scholarly meeting as the forum in which scientists share their work in advance of publication. It provides cheaper and quicker access to colleagues than the jet plane.

-The computer also allows a research team--dependent as it is on mutual teaching among its members--to span institutions. Technology may reduce the significance of the campus as the local parish, as it were, in academic life, the place where exchanges of knowledge normally take place. Will it thereby lessen in turn the importance of a few cathedral institutions as the hosts for research? Will gifted faculty members at less prestigious institutions participate more easily in research projects? Will the phenomenon of networking help to democratize opportunities for faculty members, make them a little less dependent upon local investments in a big research library and all manner of lab equipment? These questions loom large, especially for younger faculty members who have entered the job market at a time of great over-supply and who have not secured posts at institutions commensurate with their abilities.

I have put these questions to consultants at the Carnegie Foundation working on these isssues, and they said, in effect, don't count on it.

Networking may in fact intensify exclusivity. It may produce some sharp distinctions between those who are "in the know," and those with only delayed access to information through more conventional outlets.

We may, therefore, need to face again the question of what it means to "go public" with research. Traditionally, the academician differed from the detective, the lawyer, the doctor, the FBI agent and the corporation research team, in that his research did not belong to a client--whether an individual, an institution, or the nation. Publicness is the essence of academic knowledge. It should enter into the commonwealth of learning. Knowledge exists to be taught, transmitted, and shared. Nationalism, in recent decades, has challenged this universalist impulse of the Academy. "For your eyes only" has replaced the earlier ideal of "for the eyes of anyone with the skill to read and to discern." Technology, in subtler ways than nationalism, may impose further limitations on the sharing of knowledge. Networking amongst a highly select circle of collaborators narrows the community with access to the latest research. We may need further reflection on the publicness of knowledge and the obligation of professionals to give access to that knowledge in diverse fora.

At the other extreme, the computer poses a challenge to the confidentiality of knowledge, especially knowledge whose original justification was its benefit to clients. Information about patients finds its way back into data banks which, in turn, provide access to users (such as insurance companies, employers, the government) who might exploit that knowledge for their own purposes adverse to the interests of the client. Thus the computer poses new questions for an old issue: the relative balance between the values of publicity, privacy, and secrecy in a democratic society.

b. Technology, the teaching process, and the humanities. The computer, of course, comes last in a long series of technologies that have affected the teaching process in the humanities. The written word, the printing press, and the television set precede it. Traditional societies depended upon the human capacity to remember what one heard. Oral traditions were inherently public (they required both a speaker and a hearer) and potentially disputatious (they allowed for give-and-take in the course of the transmission of knowledge). The written word, by contrast, emphasizes privacy (one usually reads alone) and encourages an assertive rather than a disputatious style (inasmuch as it is not open to direct contest). The invention of letters obviously extended human powers in that it enabled messages to span the obstacles of space and time. But, as Marshall McLuhan and Fr. Walter Ong, S.J., have emphasized, it also altered, and, in some ways, reduced human capacities. Plato observed in the Phaedrus that the Egyptian God, Toth, the inventor of letters, created forgetfulness by encouraging people to rely exclusively on the external written characters.

The printing press dramatically increased and extended the power of the written word. The increase in the number of scholarly journals alone illustrates the magnitude of this technological advance--from ten journals in 1750 to 100 in 1800, to perhaps a thousand in 1850, to an estimated 30,000 to 100,000 today.[5] This so-called knowledge explosion, of course, does not produce a pure gain. Since no one, not even the expert, can master all this available knowledge, the knowledge explosion has also generated an ignorance explosion. Since, moreover, knowledge creates power, ignorance correspondingly creates a sense of powerlessness. Even the expert is ignorant, and therefore powerless in

much that affects his life. This state of affairs may help to explain the highly ambivalent feelings we harbor toward the knowledge-wielders in our culture--the doctors, the lawyers, the market experts, and the like. At once we need their expertise and yet we suspect them as they exercise power in the midst of our ignorance. Thus, changes in the process by which we acquire knowledge eventually produces a huge gap between the knowledge possessors and the society at large. A whole new class of professionals arise who become the dispensers of services from which patients, clients and the like benefit, but which at the same time renders them somewhat helpless and powerless.

The technology of television did not directly alter education as much as most people expected, at least not in the sense that television became a major aid and tool (or surrogate) for classroom teaching. But, in other ways, television has dramatically affected the teaching process. Children and young people spend more time before their television sets than in the classroom. For better or for worse, TV and allied media have largely supplanted the earlier teaching authorities of Western culture: first, the magisterium of the church; second, the apprenticeship system; and, more recently, the public school system. The ascendency of the new medium has affected the teaching function in at least three ways.

It has undermined the habit of patience which the medium of the written word requires--patience in acquiring skill in reading, patience in tracking after a line of thought that develops across the sentences and paragraphs of an essay, patience in acquiring the education that will yield as its reward a unilinear career, and patience, at length, in developing a career that requires hard work at the outset for the sake of a payoff at 45 or 50 years of age. Another name for this patience is

deferred gratification. Not surprisingly, commentators dubbed the protest generation of the late 60s--nursed by the TV set--the Now generation. Students in the new culture period oriented with a vengeance to the present. They expected their information to come in twenty-second bites. Forty seconds seems an eternity on TV. One can, of course, convey some information within those constraints, and the artful TV host can signal an attitude with a glance--the mocking tone, the lifted eyebrow, or the glittering cynicism of a Johnny Carson. But a complex appraisal, or an intricate argument, looks hopelessly out of place within the constraints of TV. Thus, one tends to settle for information rather than knowledge, wisecracks rather than wisdom, a stance toward a subject rather than its painstaking interpretation.

Perhaps the tendency of TV to encourage a cynical attitude may be its most dangerous impact on education. Everyone feels some objective warrant for cynicism in the course of his or her education. It properly undercuts the tendency to glamourize, sentimentalize, or idolize the merely ordinary. But cynicism, when it fixes itself in the young, dangerously obstructs education. It destroys the capacity for discriminate appraisal. Everything gets trashed. The noble as well as the trivial reduces to the same rubble in the cynic's eye. At its worst, cynicism is an uneducable style. The habits of impatience and cynicism which TV reinforces daily do not easily convert into the discipline required in the classroom.

Further, TV affects the very telos, or aim and purpose, of teaching. In orienting the viewer to the present moment it emphasizes chiefly gratification. Students, by habit, justify schooling for its usefulness in enlarging opportunities for consumption, by providing them with a

career and enlarging their capacity to savour those goods which a career places within reach. The medium reminds the watcher daily that, above all else, he is a consumer.

By delivering this Jeremiad I do not want to present myself as a Luddite, ready to smash any and all TV sets. In the moral life, Aristotle once noted that we should not expect to eliminate what we are but learn how to lean against our weaknesses. Similarly, we need not eliminate any and all of our prevailing technologies, but learn how to lean against their weaknesses.

While scholars in the humanities may not use the computer as much in teaching as their colleagues in the sciences, its use will surely increase, especially in highly sequential language instruction, and certainly surpass the use of TV as a teaching aid. We may expect several impacts similar to those already sketched in the discussion of the sciences. The library will broaden into an information center whose resources for sharing knowledge far transcend that of printed books and articles. The organization of information and retrieval systems allows for interactive team research that extends beyond the local campus (although humanists work less often in teams than their colleagues in the social and natural sciences). Computer-aided instruction will give the scholar and student in remote areas access to instructional resources thus overcoming some of the limitations of the bounded residential campus.

One wonders whether computer technology will diminish the role and authority of the individual teacher. Will computer technology put teachers out of business the way fluoride, dental sealants, and anti-bacterial agents have reduced the need for dentists? Martin Buber once defined the teacher as the one who experiences what the student is

going through, whereas the student does not experience what the teacher is enduring. Computers seem to comply with this definition. They anticipate our questions and mistakes, they substitute algorithms for human judgment.

Each major technological development in communications appeared to threaten the place of the teacher. Oral cultures absolutely required teachers; learners needed to hear words directly vocalized by their mentors to have access to knowledge. The written word, however, allowed one to do without the living presence of the teacher by giving access to the absent instructor, the one whose voice one had never heard. Students could work with texts in solitude. The later invention of the printing press greatly extended the reach of knowledge without the mediation of living teachers. The computer goes still further. At least the printed word gives the reader the sense that she deals with an author--a human presence to be reckoned with. Even though absent or long since dead--the author exists as a teacher. The working computer with its silicon chips simultaneously resembles the human brain as no text on the printed page does; and yet, it never gives one the sense that one reckons with an author. The original programmer remains somewhat elusive--despite the little jokes and asides and contrived intimacies inserted into the program. The advances in technology from oral to digital transmission would appear to dispense increasingly with the teacher in the acquisition of knowledge.

Yet, the teaching profession did not disappear in the course of earlier technological innovations, and we have little reason to think that the computer will eclipse the teacher today. The printed page, to be sure, dispenses with the oral transmitter of sacred stories, but it

generated a need for mediators and interpreters of established texts. The classroom also served as the generator of new texts. Teaching, if anything, became more creative. In an oral culture, teachers had to repeat what they had received. Repetition guaranteed the persistence of a tradition. The printed word allowed teachers to dispense with repetition. It left them free for the hermeneutical task of interpreting, evaluating, and applying texts to new settings and conditions. Thus the meaning of tradition itself changed. Tradition no longer entailed the umbilical receiving of stories from one's elders. One distanced oneself from a text as one received it through the acts of interpretation and re-interpretation. This more distanced form of traditioning provoked a new mode of oral discourse, not pupils reciting what they memorized, but learning to discuss a text. It thus cleared the way for the production of new texts; that is, the refurbishing of old traditions and the introduction of new ones.

In one sense, the impact of computer technology on instruction and testing in the humanities will remain limited. Except for introductory language instruction, the humanities disciplines do not easily lend themselves to sequential, unilinear, and incremental instruction. Further, true and false tests and multiple-choice examinations systematically falsify the meaning of the mastery of a subject in the humanities. Such mastery depends upon the organization of materials into intelligible wholes expressed in writing and speaking. But a very specific feature of computer technology--word processing software--should dramatically and favorably facilitate the development of that mastery.

Properly used, word-processing software will renew the importance of writing/editing in the humanities, the role of the teacher in that process, and perhaps help the student recover a sense of both the social and substantive purposes of writing.

Until recently, the sheer laboriousness of retyping papers reinforced other tendencies in American education that have discouraged students from editing and rewriting their examination papers. Teachers have merely served as judges of the final projects, giving them grades and offering a few marginal comments to justify in lawyerly fashion a given grade. Meanwhile, whatever students learned about English grammar tended to intimidate them as writers. They assumed that the rules of grammar served as rules of writing, telling them what not to do. Students must keep these stern rules in mind as they attempt to strike off error-free sentences; and since in their hearts they know that they cannot produce faultless prose, instruction in grammar tended to paralyze them as writers. Few sentences could run the gauntlet of the rules unscathed. Students thus solved their problem of writing by procrastinating until the last minute, then writing rapidly and desperately and turning in the unedited results. The ensuing grade merely confirmed what they already knew--their papers were not worth much (unless the teacher, desperate for students at a time of declining enrollments in the humanities, yielded abjectly to grade inflation and awarded cynically high grades for getting anything in at all.)

The computer will not, in and of itself, change all this, but word-processing software creates at least the objective possibility of reform. It eliminates the purely laborious side of rewriting, and therefore lets the teacher function as master editor, and encourages the

student himself to learn something about editing as he rewrites his paper, both before and after turning it in. This reform, of course, will not occur unless a student learns that the rules of grammar serve primarily not as a means of writing well, but of editing well. The art of writing is rewriting, that is, editing one's prose. Such books as the Elements of Style serve not as a manual for striking off perfect sentences but rather as a help in identifying lame sentences and learning how to fix them.

This "fixing up" of one's prose, however, will trivialize if it seems no more than a way in which one learns how to dress up what one already knows. At its best, the discipline of writing an essay is a heuristic enterprise in which one does not merely package and disseminate what one already knows, but partly discovers it through the eyes of a stranger. As the saying goes, one learns through teaching. To the degree that the computer assists the student in becoming a better teacher through his writing, it strengthens the student as a student.

We will not, however, fully exploit these potentialities of the computer unless teachers accept it as part of their responsibility to develop students into good teachers whether they go into the teaching profession or not. Today, professors bemoan the fact that few of their students will enter the field of teaching. They flock for economic reasons to the non-academic professions. But that does not mean that they need not be good teachers of what they know in their writing and speaking. To do a good job in preventive medicine today a physician must be an effective teacher of her patient; to do a good job of counseling the client, the lawyer must effectively teach her client; to be effective in politics, a leader must effectively persuade his fellow citizens;

admittedly, business executives lead largely by command and obedience, but if they would cultivate the next generation of business leaders, they must learn how effectively to persuade their juniors and colleagues. The so-called non-academic professions need people with enhanced teaching prowess.

If teachers accept it as part of their professional responsibility to develop all their students as teachers, then they will need to revise the way in which they set assignments and examinations and conduct their seminars. When students write examinations today in the humanities (I leave aside multiple-choice and true or false exams in which teachers systematically suppress the impulse to teach), they adopt a kind of Morse Code. They invoke terms; they signal words rather than arrange thoughts in intelligible wholes. Their bad writing habits do not merely reflect laziness. The very social setting of the examination tends to encourage an unrevealing shorthand. After all, students write the examination for the teacher whom they (sometimes mistakenly) assume knows more about the subject than they do. They want merely to prove that they know the subject; they do not attempt to teach effectively and imaginatively what they know. It may make sense on examinations and papers to ask students to assume that an intelligent but ignorant friend has put the question, to help them break out of constricting jargon.

The loss of their traditional preferred constituencies of pre-professionals and professionals may help teachers themselves to teach and write better. They will need to learn how to reach out to a largely non-professional audience. The discipline of sharing with these new constituencies may affect favorably their own teaching and writing, and, perhaps, if the foregoing is correct, even their grasp of their subject.

As humanists learn how to open up their subjects for potential lawyers, doctors, and other strangers, they may acquire a fresh grasp of their sources and resources. At a minimum, increased attention will have to be paid to the quality of their own writing.

The computer will not, in and of itself, produce these substantive changes for students and teachers, but it places this exciting reform in education within our reach.

c. Technology and the Content of Teaching in the Humanities. It would be foolish to restrict discussion to the impact of technology on the process of teaching. One must acknowledge as well its impacts on the society at large which eventually affect the content of teaching. The successes of technology are many, but at the same time, it has created a whole range of problems that surface almost daily in our newspaper headlines, such as toxic waste, acid rain, nuclear arms, the rapid dissipation of both non-renewable and renewable resources, and the dozens of impossible quandaries that beset the medical profession today. In their first reaction to these weighty problems students retreat into a privatistic careerism. "I can't do anything about it. So screw it. I'll take care of myself." Alexander Astin of UCLA states that all indices across fifteen years show student interest in public issues declining. This withdrawal of students from public to private life has impoverished what might be called the civic self. This withdrawal coordinates further with the positivist dismissal of moral judgments to the realm of the private, emotive, and subjective, thus providing an intellectual justification for the neglect of shared values in our common life.

In the long run, however, this privatistic careerism may force us to rethink the content of teaching--better yet, the aim and intention of teaching. Oddly enough, it may lead eventually to the recovery of the classical mission of the liberal arts in the university curriculum. These ancient and honorable, but somewhat neglected, disciplines took it as their purpose: one, to cultivate critical intelligence, and two, to cultivate the civic self.

Since World War II, universities have tended to restrict their task to the training of technical rather than critical intelligence. Technical intelligence tells one how to get from here to there. Critical intelligence asks whether the there is worth getting to. It raises what has been incessantly called the question of ends or values. The modern positivist university has asserted that values are merely a matter of subjective preference and, therefore, do not qualify as a fit subject for critical study and judgment. (See Max Weber's classic essay on the issue, "Science As a Vocation.")

This positivist dismissal of values to the merely subjective prepared for a privatistic careerism in the student body. Since the university does not offer an area where reasoned discourse, debate, and discriminate judgments can be made on the subject of values without deteriorating into propaganda or advocacy, the information it offers is up for grabs to the highest bidder. Knowledge itself is a private property, not a public trust, to be sold entirely for private advantage. Who is to say otherwise? Certainly not professors who dismissed values as merely subjective. Thus the professional skills of students, finely honed in the descriptive disciplines, ended up for hire to further any and all private career aims.

We underestimate, however, the human intelligence if we assume that it can only give us information as to how to pursue ends but can raise no basic questions about the ends pursued, if it can bestow upon us techniques, but cannot subject to disciplined reflection and discourse the question of the ends which our techniques and technologies serve.

Second, our universities, if they would serve more than the privatistic career aims of our students, must help nurture the civic self. It must do so because modern technicians and professionals are, in effect, the new rulers in the west--they wield vast power in our society, a knowledge-based power. It is passing strange to have a ruling class without nurturing and cultivating a sense of civic responsibility in that class.

Ultimately, the nurturing of the civic self and the encouragement of critical inquiry belong to one and the same enterprise if value questions are not merely matters of private, subjective preference. To engage in critical inquiry is itself a social act that teases the mind out of the bottle of private preference and opens out toward a community of inquirers. We take our first stuttering moves toward citizenship when we can go beyond the bare ejaculations, "Well, I like this movie," or, "I don't like that play," and begin to offer intelligible explanations to our colleagues for our views. This kind of reasoned discourse tutors us in citizenship with one another. At its best, a liberal arts education is not a private transaction between the professor and her students. The classroom becomes a public place; the library, a commonwealth of learning; and critical inquiry among peers a kind of parliament of the human mind. Such critical inquiry is indispensable to technicians and professionals who have more than esoteric services to offer for private gain.

Will the computer itself assist us in addressing some of these problems, which technology and computer technology partly raise and with which the liberal arts must cope? Perhaps so--in one obvious, and in a second, relatively unexpected way.

First, one hopes that some problems generated by the mastery and control of the human environment will yield to yet further, more sophisticated technological interventions. The Romantics and Luddites among us scoff at this. They have reacted against technological triumphalism and grow skeptical, indeed cynical, about the optimistic assumption that technology has created no problem which it could not also solve. Still, one should not overlook ways in which technologists may learn from their mistakes. Computer studies of aerodynamics have helped design more fuel-efficient planes than their predecessors. The computer encourages letting form follow function instead of imitating old, pre-established, but inefficient forms. Older industrial technologies will give way to the less invasive and abusive subtleties of high-tech.

But computers may assist us also in a less expected way. Computers do not function simply as extensions of the human power to control nature, they also evoke in their users what Sherry Turkle of M.I.T. has called metaphysical questions and questions of one's own psychological identity. If Dr. Turkle is right, the computer may influence reflection in the humanities on some of the more enduring issues these disciplines face.

Turkle has observed that young users of the computer--six to eight years of age--are given at first to a kind of metaphysical animism. They impute human intelligence to the machine. This imputation provokes, in

turn, thought about the distinction between human beings and the machine. The very resemblance of the computer to human intelligence provokes fundamental thought amongst young and old on the distinctively human. Interpretations differ.

Joseph Weizenbaum, fearful of the growth of instrumental reason in our culture--linear, logical and rule-governed thought--identifies the distinctively human with the ineffable, the uncodable, the uncapturable in language or formalist reasoning. John Searle argues that the computer follows rules which it does not itself understand. Human intelligence differs from purely operational, computational and manipulative intelligence by virtue of its capacities for self-reflection and self-understanding. Turkle, drawing on her studies of young children and their use of computers, locates the difference elsewhere. The machine doesn't have a mother; the machine doesn't suffer the experience of loss. Turkle writes:

> . . . we are born, we are nurtured by parents, we grow, we develop sexually, we become parents in our turn, we die. . . .A being that is not born of a mother, that does not feel the vulnerability of childhood, a being that does not know sexuality or anticipate death, this being is alien. We may be machines, but it is our mortality that impels us to search for transcendence--in religion, history, art, the relationships in which we hope to live on.[6]

I would add a further distinction between human reason and the computer--the human capacity to strike off a metaphor or simile; that is, to juxtapose two ordinarily dissimilar entities and to see them both better by virtue of that juxtaposition. This capacity to strike off metaphors lies at the root of our power to tell stories, and to traffic

in images and symbols that shape our personal and collective lives. It would be foolish to argue that interaction with the computer for the first time uncovers the aforementioned distinctions between human beings and the machine. But widespread interaction may provoke the culture at large and the educational system in particular to think more deeply and afresh about these distinctions, and, to the degree that it does so, it may uncover and recover some of the intellectual resources which our culture requires as it faces the problems posed by abrasive technological change.

If Turkle can be credited, interaction with the computer not only augments mastery and provokes metaphysical questioning, it also provokes in adolescents (but also in others) a quest for personal self-interpretation, recognition, and identity.

At first glance this interaction would seem to lead in the opposite direction--to an escape from oneself and from others. Does not the computer already tempt young people only too bereft of social skills to avoid others? Will it not produce a generation of asocial computer hacks? Does it not encourage a narcissism, a withdrawal into oneself, accompanied only by the machine, precisely at that time in life when the student acutely needs to develop the social self or the civic self? Turkle's study suggests, however, a somewhat different outcome. The Narcissus myth need not lead inevitably to asocial, solepsistic withdrawal.

> There is another way to read the story. Narcissus fell in love with what appeared to him to be another. This image of that other person fascinated him because it objectified a sense of beauty of which he had felt only a vague inner

> sense. . .When you program a computer, there's a little piece of your mind, and now it's a little piece of the computer's mind, and now you can see it.[7]

This seeing of oneself at a little distance, in perspective, as it were, allows for a bit of self-interpretation, discovery of identity, and, in some touching cases, provides a clue to a new identity.

The computer itself provides metaphors for self-interpretation, in some cases optimistic, in other cases, pessimistic. Optimistic metaphors, such as "reprogramming" or, "getting the bugs out of the system," may, of course, deceive. They suggest that "painful emotional states--depression, inability to act, anxiety--are the result of purely local bugs,"[8] and thus they mislead about deep-going structures and syndromes. At the same time, the metaphor of the computer "loop" may deceive in the direction of pessimism; that is, the fear that the self is a "vicious programming circle where all paths lead back to the same unproductive starting point."[9]

In any event, let no one be deceived about the computer itself. It may not be able to produce a metaphor, but it fairly bristles with them in interaction with its human users. "Whether or not computer scientists ever create an artificial intelligence that can think like a person, computers change the way people think--especially about themselves."[10] Therein may be their last and finest contribution to the content of humanistic thinking and teaching.

Footnotes

1. Daniel Bell, The Winding Passage, (New York: Basic Books, Harper, 1980) p. 7.

2. Benjamin Farrington, The Philosophy of Francis Bacon, (Liverpool: Liverpool University Press, 1964).

3. Ibid., p. 28.

4. Ibid.

5. Op.Cit., pp. 53-54.

6. Sherry Turkle, The Second Self; Computers and the Human Spirit, (New York: Simon and Schuster, 1984), p. 311.

7. Ibid., p. 155.

8. Ibid., p. 160.

9. Ibid., p. 161.

10. Ibid., p. 162.